

Image AF/GAU 1631



PTO/SB/21 (02-04)

Approved for use through 07/31/2006. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**TRANSMITTAL
FORM**

(to be used for all correspondence after initial filing)

Application Number	09/275,568
Filing Date	3/24/1999
First Named Inventor	Michael C. Pitman
Art Unit	1631
Examiner Name	Cheyne D. Ly
Attorney Docket Number	YOR919980112

Total Number of Pages in This Submission 52

ENCLOSURES (Check all that apply)

- | | | |
|---|--|---|
| <input type="checkbox"/> Fee Transmittal Form
<input type="checkbox"/> Fee Attached
<input type="checkbox"/> Amendment/Reply
<input type="checkbox"/> After Final
<input type="checkbox"/> Affidavits/declaration(s)
<input type="checkbox"/> Extension of Time Request
<input type="checkbox"/> Express Abandonment Request
<input type="checkbox"/> Information Disclosure Statement
<input type="checkbox"/> Certified Copy of Priority Document(s)
<input type="checkbox"/> Response to Missing Parts/Incomplete Application
<input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53 | <input type="checkbox"/> Drawing(s)
<input type="checkbox"/> Licensing-related Papers
<input type="checkbox"/> Petition
<input type="checkbox"/> Petition to Convert to a Provisional Application
<input type="checkbox"/> Power of Attorney, Revocation
<input type="checkbox"/> Change of Correspondence Address
<input type="checkbox"/> Terminal Disclaimer
<input type="checkbox"/> Request for Refund
<input type="checkbox"/> CD, Number of CD(s) _____ | <input type="checkbox"/> After Allowance communication to Technology Center (TC)
<input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences
<input checked="" type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
<input type="checkbox"/> Proprietary Information
<input type="checkbox"/> Status Letter
<input checked="" type="checkbox"/> Other Enclosure(s) (please identify below):
Postcards |
|---|--|---|

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Michael J. Buchenhorner
Signature	<i>Michael J. Buchenhorner</i>
Date	March 12, 2004

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Michael J. Buchenhorner		
Signature	<i>Michael J. Buchenhorner</i>	Date	March 12, 2004

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

HOLLAND & KNIGHT LLP

701 Brickell Avenue, Suite 3000
P.O. Box 015441 (ZIP 33101-5441)
Miami, Florida 33131

305-374-8500
305-789-7799 Fax
www.hklaw.com



Annapolis	San Antonio
Atlanta	San Francisco
Bethesda	Seattle
Boston	Tallahassee
Bradenton	Tampa
Chicago	Washington, D.C.
Fort Lauderdale	West Palm Beach
Jacksonville	International Offices:
Lakeland	Caracas*
Los Angeles	Helsinki
Miami	Mexico City
New York	Rio de Janeiro
Northern Virginia	São Paulo
Orlando	Tel Aviv*
Portland	Tokyo
Providence	
St. Petersburg	*Representative Office

March 12, 2004

MICHAEL J. BUCHENHORNER
305-789-7773
mjbuchen@hklaw.com

VIA FIRST CLASS MAIL

Commissioner of Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Re: Application No. 09/275,578
Filing Date: 3/24/1999
First Named Inventor: Michael C. Pitman
Art Unit: 1631
Examiner Name: Ly, Cheyne D.
Attorney Docket No. YO998-112

Sir:

The attached Second Substitute Appeal Brief is in response to the Notification of Non-Compliance with 37 CFR 1.192(c). We do not believe that an additional fee is due but in the event that it were, please deduct our deposit account No. **50,2870**.

Very truly yours,

HOLLAND & KNIGHT LLP

A handwritten signature in cursive script that reads "Michael J. Buchenhorner".

Michael J. Buchenhorner

MJB/mr

1777422_v1



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for patents, P. O. Box 1450, Alexandria, VA 22313-1450.

On March 12, 2004
Date of Deposit

Michael J. Buchanan
Signature

In re Application of: PITMAN et al.

Serial No.: 09/275,568

Group Art Unit: 1631

Filed: 03/24/99

Examiner: Cheyne D. Ly

Title: Similarity Searching of Molecules Based Upon Descriptor Vectors Characterizing Molecular Regions

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SECOND SUBSTITUTE APPEAL BRIEF

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed May 30, 2003.

REAL PARTY IN INTEREST

International Business Machines Corporation is the real party in interest as assignee of the subject application.

RELATED APPEALS AND INTERFERENCES

The Appellant, the Appellant's legal representative, and the Assignee are not aware of any other appeals or interferences which will directly affect, be directly affected by, or have a bearing on the Board's decision in this Appeal.

STATUS OF CLAIMS

Claims 1 and 4 through 15 (the claims at issue) are pending in the above-identified patent application. The claims at issue were finally rejected in an Office Action dated January 27, 2003. The final rejection of the claims at issue is hereby appealed.

The claims at issue all stand rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Claim 1 has been rejected under 35 U.S.C. § 102(e)(2) as being anticipated by Platt et al (U.S. Patent 5,784,294, hereafter "Platt"). The final Office Action rejected claims 1 and 4, under 35 U.S.C. § 112, first paragraph, as containing subject matter that was not described in the original specification as to convey to one skilled in the art that the inventor possessed the claimed invention.

STATUS OF AMENDMENTS

The above-identified patent application was filed on March 24, 1999. An Office Action (Paper No. 3) was issued on September 13, 2001, rejecting claims 1 through 30. On November 2, 2001 an Amendment was filed in response to the Office Action, wherein claims 16 through 30 were cancelled. A Non-Final Office Action was issued on August 8, 2002 rejecting claims 1 through 15. In response to that Office Action applicants filed an amendment on November 13, 2002 amending claims 1, 4, and 5 and canceling claims 2 and 3. On January 27, 2003 the Examiner issued a final Office Action rejecting all of the claims at issue. On May 30, 2003 a Notice of Appeal to the Board of Appeals was filed.

SUMMARY OF INVENTION

The present invention, as set forth in claim 1, and as described and shown in the specification and the Figures of the above-identified patent application, is directed to a method for generating and storing data characterizing at least one region of said plurality of regions, the method comprises the steps of:

generating an entry [page 3, line 18] comprising i) an identifier that identifies said at least one region, and ii) data characterizing a set of axes derived from a property distribution of said at least one region [page 3, lines 19-20];

applying a mapping to the descriptor vector associated with said at least one region [page 3, lines 20-21] based on preselected criteria [page 3, lines 10-13];

generating a key that corresponds to said mapping of the descriptor vector associated with said at least one region [page 3, lines 20-21]; and

storing said entry in a memory [page 3, line 21], wherein said key is associated with said entry such that the key indexes the entry for retrieval thereof [page 4, lines 2-3]. A concept underlying the claimed invention is the storage of data in groupings that are sensitive to the way a human would search for stored information, thus facilitating retrieval of the stored data in a way that is useful for using the molecules.

ISSUES

- I. Whether the Examiner erred in rejecting claims 1 and 4-15 as being directed to non-statutory subject matter.
- II. Whether the Examiner erred in rejecting claim 1 under 35 U.S.C. §102(e)(2). as being anticipated by U.S. Patent Number 5,784,294 (Platt).
- III. Whether the Examiner erred in rejecting claims 1 and 4 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor possessed the invention.

- IV. Whether the Examiner erred in rejecting Claims 1 and 4-15 under 35 U.S.C. §112, second paragraph for failing to point out and distinctly claim the subject matter which applicant regards as the invention.

GROUPING OF CLAIMS

For purposes of this Appeal, the claims at issue stand or fall together.

ARGUMENT

I. CLAIM REJECTIONS UNDER 35 U.S.C. § 101

The Examiner erred in rejecting the claims at issue under 35 U.S.C. §101 on grounds that the claimed invention is allegedly directed to non-statutory subject matter.

The analysis of whether a claim is directed to statutory subject matter begins with the language of 35 U.S.C. 101, which reads:

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

In AT&T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 50 USPQ2d 1447 (Fed. Cir. 1999), the United States Court of Appeals for the Federal Circuit said that the Supreme Court has construed 101 broadly, noting that Congress intended statutory subject matter to "include anything under the sun that is made by man." See Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. Rep. No. 82-1979, at 5 (1952); H.R. Rep. No. 82-1923, at 6 (1952)); see also Diamond v. Diehr, 450 U.S. 175, 182 (1981). Notwithstanding the broad scope statutory subject matter, the Court has specifically identified three categories of unpatentable subject matter: "laws of nature, natural phenomena, and abstract ideas." See Diehr, 450 U.S. at 185.

In this appeal, all of the claims at issue are method claims which fall within the "process" category of the four enumerated categories of patentable subject matter in 101. The examiner determined that the claims at issue recite a method that "is merely arranging the data based on an algorithm without any practical application."

The subject patent application claims methods or processes for generating and storing data. Moreover these processes are performed by a machine (a data processing system). The data are expressed and processed as electrical signals operated upon by a processing apparatus. That is a practical application of the invention. The claim also states in the storing step that the key is associated with the subject data entry for retrieval thereof.

The Examiner's determination constitutes an error of law. The issue of failure to claim statutory subject matter is one of law that is reviewed de novo. See AT&T Corp. v. Excel Communications, Inc., *supra*.

The storage of data in a computer memory is by itself a concrete and useful result. Claim 1 which is representative includes four steps that precisely set forth how the subject information is stored in memory. In In re Lowry, 32 F. 3d 1579, 32 USPQ2d 1031 (Fed. Cir. 1994), the Federal Circuit held that claims directed to an invention related to "storage, use, and management of information residing in a memory were entitled to patentable weight." In Lowry, the Board of Patent Appeals and Interferences reversed the statutory subject matter rejections made by the Examiner under 35 U.S.C. §101. The Federal Circuit then went further by holding that claim limitations relating to the storage of information in a computer memory are entitled to patentable weight in distinguishing the prior art. The method claimed in the instant application is similar to the storage of data in Lowry. Storage of information in a computer memory is an important aspect of information technologies because information processing apparatus

must read data from computer memory to execute operations on that information. Considering the claims at issue as a whole, as they must be, it becomes clear that the information stored in a memory has a practical purpose beyond the mere storage of the information – retrieval of the stored information based on the key mapped to a descriptor vector. The ability to retrieve information from memory based on various criteria is perhaps as important as storage of the information.

The technology of search engines which is the subject of numerous patents is concerned with this very concept. Failure to provide patent protection to inventions in the art of data retrieval would violate the constitutional mandate of promoting the progress of science and the useful arts. Therefore, the rejection of the claims at issue for failure to recite statutory subject matter must be reversed.

In the final office action dated January 27, 2003, the Examiner rejected appellants' arguments and reasserted the position that the claims are directed to unpatentable subject matter. The Examiner thus contended that: "An invention where a system merely stores data such as descriptor vectors associated with a plurality of regions of molecules onto a media [sic, medium] is considered to be non-statutory subject matter because the said data is considered to be nonfunctional descriptive material." This rejection is nothing more than an application of the "printed matter" category of non-patentable subject matter that was so clearly discredited and reversed in the In re Lowry decision. As noted above, the general rule of patentable subject matter is expansive and any determination of failure to claim statutory subject matter must find its support in the case law. In the final office action the Examiner concedes that the claimed invention does not lack utility under section 101 of the patent statute. Therefore, the rejection is either based on the printed matter exception or on the algorithm exception to the rule of patentability. As noted above, storage of data (which is by its nature descriptive) is a very important aspect of the information technology arts. That fact was recognized in In re Lowry when the Federal Circuit laid to rest the doctrine of printed matter as applied to

data stored in computer readable media. The Federal Circuit's decision in In re Lowry requires reversal of the Examiner's determination of failure to claim statutory subject matter.

To the extent that the Examiner's section 101 rejection relied on the mathematical algorithm doctrine it must also be reversed. In AT&T, supra, the Federal Circuit said that any step-by-step process involves an algorithm in the broad sense of the word. The AT&T court thus said: "Since the process of manipulation of numbers is a fundamental part of computer technology, we have had to reexamine the rules that govern the patentability of such technology. The sea-changes in both law and technology stand as a testament to the ability of law to adapt to new and innovative concepts, while remaining true to basic principles." AT&T, 172 F.3d at 1356. Thus the AT&T court limited the "Algorithm" doctrine to apply only in cases of purely "abstract" algorithms. See AT&T at 1357. In AT&T, the Federal Circuit also said that the algorithm must be applied in a useful way and found a practical result in the claimed methods in the addition of certain descriptive information called a PIC (or primary interchange carrier) to certain other information used in switching telephone calls. The information in the claims at issue in the instant case also has a useful result – the storage for retrieval of information from a computer memory responsive to a search for certain criteria. The retrieved information is useful for, among other purposes, determining properties of molecules.

The Examiner's argument that the information stored according to the claims at issue is merely descriptive if applied to the field of photography would preclude the patentability of cameras because cameras take light, one form of information that represents an object, and record the information in film. The information is merely descriptive of the subject of the photograph. The application of the Examiner's reasoning to the clearly patentable area of photograph illustrates the point that the claimed invention which is analogous to other forms of data storage should not be precluded from patentability.

The Federal Circuit rejected an argument similar to the Examiner's Arrhythmia Research Technology, Inc. v. Corazonix Corp., 22 USPQ2d 1033 (Fed. Cir. 1992), where processing information describing a patient's heartbeat was held to be statutory subject matter. The court there said that the claims at issue did not preempt all uses of the algorithm, Arrhythmia at 1060. Similarly, in the instant case the claims do not preempt all uses of any algorithms; rather they are limited to storage and retrieval in a computer memory. Therefore, appellants request reversal of the rejection of the claims at issue under 35 U.S.C. §101.

II. CLAIM REJECTIONS UNDER 35 U.S.C. §102(e)(2)

Claim 1 was rejected under 35 U.S.C. § 102(e)(2) as being anticipated by Platt (U.S. Pat. No. 5,784,294). This rejection should be reversed because the Examiner has not shown that claim 1 is anticipated by Platt. Nowhere does Platt teach or disclose *any* of the elements of claim 1. Platt relates to a storage device that performs a plurality of functions that produce a result that can be an input to the method of claim 1 of the instant application but which does not anticipate the claims at issue. Platt does not disclose the required mapping, generation of a key, or string the entry as required by claim 1.

In the final office action, the Examiner contends that Platt discloses at Fig. 9 "storing an entry comprising a molecular descriptor with a key to access it." Fig. 9 of Platt is a flow chart illustrating use of descriptors. It does not relate to a mapping of descriptor vectors (as claimed) at all. The key generated according to claim 1 corresponds to the mapping. The Examiner has not shown how Fig. 9 of Platt performs a mapping or any of the claimed steps.

The Examiner further says "Platt et al. teaches storing said first and second descriptors of each molecule in said series of molecules in a database for subsequent processing to

thereby identify correspondence between molecules in said series of molecules (Claim 34, Lines 39-42).” That statement does not describe any of the claimed steps. The claimed step of “storing” relates to the entry defined in the first step. The section of Pratt cited has nothing to do with such an entry and hence cannot correspond to the claimed storing step, or any other claimed step.

The Examiner also argues that the “key” is inherent. Again, the claimed “key” corresponds to the claimed mapping and the Examiner has not shown anything in Platt corresponding to such a mapping. Instead, the Examiner argues that Platt has some criteria for selecting molecules of the training set to be placed in a table and that this corresponds to “applying the mapping.” The Examiner does not show how the placement of molecules in a table relates even remotely to applying a mapping to a descriptor vector as claimed and has fallen far short of the exact relationship that anticipation requires.

Finally, the Examiner has erred as a matter of law by arguing that a type of data structure allegedly disclosed in Platt “is consistent with” the limitation of “key indexes to entry for retrieval thereof.” The legal test for anticipation is whether every element of a claim is found in an item of prior art, and not whether a structure is consistent with a claimed method. Therefore, appellants request reversal of the rejections under Section 102(e).

III. CLAIM REJECTIONS UNDER 35 U.S.C. § 112, FIRST PARAGRAPH

The final Office Action rejected claims 1 and 4, under 35 U.S.C. § 112, first paragraph, as containing subject matter that was not described in the original specification as to convey to one skilled in the art that the inventor possessed the claimed invention. The examiner (or the Board, if the Board is the first body to raise a particular ground for rejection) “bears the initial burden . . . of presenting a prima facie case of unpatentability. “ In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir.

1992). Insofar as the written description requirement is concerned, that burden is discharged by “presenting evidence or reasons why persons skilled in the art would not recognize in the disclosure a description of the invention defined by the claims.” In re Wertheim, 541 F.2d 257, 263, 191 USPQ 90, 97 (CCPA 1976). Thus, the burden placed on the examiner varies, depending upon what the applicant claims. The specification contains a description of the claimed invention, albeit not in ipsis verbis (in the identical words), then the examiner or Board, in order to meet the burden of proof, must provide reasons why one of ordinary skill in the art would not consider the description sufficient. *Id.* At 264, 191 USPQ at 98. In the present case, the amendment of November 13, 2002, amended claim 1 so that the step of applying a mapping to the descriptor vector is based on pre-selected criteria. Support for the amendment does not have to be *ipsis verbis*. It is inherent from the discussion in page 40 of the specification that the application of the mapping is based on pre-determined criteria. Note that the discussion (page 40) of the “association criteria” is defined in the prior training phase and thus clearly the association criteria were “pre-determined.”

Claim 1 was further amended to state that “the key indexes the entry for retrieval thereof.” It is inherent in the claimed invention that the key indexes the entry for retrieval of the entry. Why else would a key corresponding to a mapping be used? In any case, the gist of the written description requirement is to prevent an applicant from adding claims to subject matter that the inventor did not possess at the time of filing. Vas-Cath Inc., v. Mahurkar, 935 F.2d 1555, 19 USPQ2d 111 (Fed. Cir. 1991). As appellants noted in the amendment of November 13, 2002, the amendment was not made to define additional subject matter but to make clear what was already implicit. Applicant again poses the question – why would information be stored if not for retrieval thereof?

The Examiner has not shown any reason why the language added in the amendment would not be supported by the specification and in fact appellants contend that the

amendment was not made for purposes of patentability, so the invention defined by the claims both before and after the amendment are the same and hence was clearly in the possession of the inventor at the time of the filing of the application. Therefore, appellants request reversal of this rejection.

IV. CLAIM REJECTIONS UNDER 35 U.S.C. §112, SECOND PARAGRAPH

The final office action also rejected claims 1 and 4-15 under 35 U.S.C. §112, second paragraph as being indefinite. Specifically, the final office action contends that claim 1 is vague and indefinite due to lack of clarity in the preamble and that it is not clear to the examiner whether the applicant intended to claim a data processing system or a method. Applicant contends that this ground for rejection was error and requests reversal thereof. Claim 1 clearly states that it is directed to a method for generating and storing data and recites a series of steps. The reference to a data processing system is preceded by the word "in" and is thus an introductory phrase that merely indicates a field of use for the claimed method. See *Kropa v. Robie*, 187 F.2d 150, 158 (CCPA 1951). The final office action has not shown that claim 1 is indefinite because it would be error of law to construe claim 1 as being directed to a system. Claims 4-15 were rejected on the basis that they are dependent on claim 1 and their rejection should also be reversed on the forgoing grounds.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the application and the claims are in condition for allowance. Reversal of the final rejection, and allowance of the claims as amended, are requested.

Respectfully submitted,

By: Michael J. Buchenhorner
Michael J. Buchenhorner
Registration No. 33, 162
Attorney for Applicants

Date: March 12, 2004

APPENDIX

1. (Amended) In a data processing system wherein descriptor vectors associated with a plurality of regions of molecules are stored in a database, a method for generating and storing data characterizing at least one region of said plurality of regions, the method comprising the steps of:

generating an entry comprising i) an identifier that identifies said at least one region, and ii) data characterizing a set of axes derived from a property distribution of said at least one region;

applying a mapping to the descriptor vector associated with said at least one region based on preselected criteria;

generating a key that corresponds to said mapping of the descriptor vector associated with said at least one region; and

storing said entry in a memory, wherein said key is associated with said entry such that the key indexes the entry for retrieval thereof.

2. (Cancelled) The method of claim 1, wherein said set of axes are invariant to rotation and translation of said at least one region.

3. (Cancelled) The method of claim 2, wherein said set of axes are derived from principal axes of said property distribution.

4. (Amended) The method of claim 1, wherein said property distribution of said at least one region is computed from a convolution with a probe function to a property field.

5. (Amended) The method of claim 1, wherein said plurality of descriptor vectors are classified into groups, and wherein said mapping step maps said descriptor vectors to a space discriminating between said groups of descriptor vectors.

6. The method of claim 5, wherein said mapping is derived from the steps of:
generating first data representing differences between said groups of descriptor vectors;

generating second data representing variations within said groups of descriptor vectors;

identifying a set of component vectors that maximizes an F distributed criterion function, said criterion function having a numerator based upon said first data and a denominator based upon said second data;

generating an F distributed statistic for subsets of said component vectors, said statistic having a numerator based upon said first data and a denominator based upon said second data;

for each particular subset of component vectors, calculating a probability value for the F-distributed statistic associated with the particular subset;

selecting a probability value from probability values for said subsets of component vectors based upon a predetermined criterion;

identifying the subset of said component vectors associated with the selected probability value; and

generating a mapping to a space corresponding to the subset of component vectors associated with the selected probability value, and storing the mapping for subsequent processing.

7. The method of claim 6, wherein said first data comprises a matrix ϵ_b representing covariance between said groups of descriptor vectors, and said second data comprises a matrix ϵ_w representing covariance within said groups of descriptor vectors.

8. The method of claim 7, wherein said criterion function has the general form:

$$f(\hat{w}) = C \left(\frac{\hat{w}^T \epsilon_b \hat{w}}{\hat{w}^T \epsilon_w \hat{w}} \right)$$

where \hat{w} is some vector, and C is a constant based upon degrees of freedom in ϵ_b and ϵ_w .

9. The method of claim 8, wherein C is determined as follows:

$$C = \frac{1/\text{degrees of freedom in } \epsilon_b}{1/\text{degrees of freedom in } \epsilon_w} = \frac{1/(N-1)}{1/(\sum n_i - N)}$$

where N represents the number of groups of descriptor vectors, n_i represents the number of regions, and $\sum n_i$ represents the sum of n_i for the N groups.

10. The method of claim 7, wherein the step of identifying a set of component vectors that maximizes an F distributed criterion function comprises the substeps of:

determining a set of (eigenvalue, eigenvector) pairs for the matrix ϵ_w

determining said set of component vectors based upon said set of (eigenvalue, eigenvector) pairs for the matrix ϵ_w .

11. The method of claim 10, wherein said statistic for a given subset of component vectors is based upon value of said criterion function for said subset of component vectors.

12. The method of claim 11, wherein said statistic for a given subset of component vectors has the following form:

$$\Psi_s = C \left(\frac{1}{L_s} \right) \sum f_k$$

where f_k represents the value of the criterion function at a component vector in the given subset,

C is a constant,

L_s represents the number of f_k values in the given subset of component vectors, and the Σ operation sums over the L_s f_k values in the given subset of component vectors.

13. The method of claim 12, wherein said a probability value for a particular F-distributed statistic represents a probability value that the particular F-distributed statistic could have been larger by chance.

14. The method of claim 13, wherein said probability value selected from probability values for said subsets of component vectors is a minimum probability value of said probability values for said subsets of component vectors.

15. The method of claim 6, wherein said mapping for said at least one descriptor vector performs a loop over each component vector belonging to the subset of component vectors associated with the selected probability;

wherein, in each iteration of said loop, dot product of said descriptor vector with a transpose of a unit vector for the given component vector is added to a running sum.

1775277_v1